WHAT IS CLAIMED IS:

1. A method of growing a CdS/ZnS graded shell, comprising:

   providing a core,

   combining the core with at least one surfactant,

   heating the mixture,

   combining the mixture with a CdS/ZnS stock solution,

   wherein the core comprises a semiconductor material, and

   graded core/shell nanorods are produced.

2. The method of claim 1, wherein:

   the core is rod shaped.

3. The method of claim 2, wherein:

   the core comprises CdSe.

4. The method of growing a CdS/ZnS graded shell of claim 1, wherein:

   the mixture is heated to a temperature between 100-360 °C.

5. The method of growing a CdS/ZnS graded shell of claim 1, wherein:

   the mixture is heated to a temperature of 160°C.

6. The method of growing a CdS/ZnS graded shell of claim 1, wherein:

   the core is combined with only one surfactant.

7. The method of growing a CdS/ZnS graded shell of claim 1, wherein:

   the surfactant is chosen from the group consisting of TOPO, TBP, HDA, HPA and TDPA.

8. The method of growing a CdS/ZnS graded shell of claim 1, wherein:

   the mixture is kept at a temperature of approximately 160° for between 5 minutes and 24 hours after combining the CdS/ZnS stock solution.

9. The method of growing a CdS/ZnS graded shell of claim 8, wherein:

the mixture is kept at a temperature of 160°C for 10 minutes after combining the CdS/ZnS stock solution.

10. The method of growing a CdS/ZnS graded shell of claim 1, wherein:

the core is a shaped nanorod.

11. The method of growing a CdS/ZnS graded shell of claim 10, wherein:

the core has a tetrapod shape.

12. The method of growing a CdS/ZnS graded shell of claim 1, wherein:

the graded core/shell nanorods are photochemically annealed.

13. The method of growing a CdS/ZnS graded shell of claim 12, wherein:

the annealing is done using an Ar+ laser.

14. A method of growing a CdS/ZnS graded shell, comprising:

providing a core/surfactant mixture,

heating the mixture,

combining the mixture with a CdS/ZnS stock solution.

15. The method of growing a CdS/ZnS graded shell of claim 14, wherein:

the core is rod shaped.

16. The method of growing a CdS/ZnS graded shell of claim 15, wherein:

the core comprises CdSe.

17. The method of growing a CdS/ZnS graded shell of claim 14, wherein:

the mixture is heated to a temperature between 100-360 °C.

18. The method of growing a CdS/ZnS graded shell of claim 14, wherein:

the mixture is heated to a temperature of 160°C.

19. The method of growing a CdS/ZnS graded shell of claim 14, wherein:

the core/surfactant mixture contains only one surfactant.

20. The method of growing a CdS/ZnS graded shell of claim 14, wherein:

the surfactant is chosen from the group consisting of TOPO, TBP, HDA, HPA and TDPA.

21. The method of growing a CdS/ZnS graded shell of claim 14, wherein:

the mixture is kept at a temperature of approximately 160° for between 5 minutes and 24 hours after combining the CdS/ZnS stock solution.

22. The method of growing a CdS/ZnS graded shell of claim 21, wherein:

the mixture is kept at a temperature of 160°C for 10 minutes after combining the CdS/ZnS stock solution.

23. The method of growing a CdS/ZnS graded shell of claim 14, wherein:

the core is a shaped nanorod.

24. The method of growing a CdS/ZnS graded shell of claim 23, wherein:

the core has a tetrapod shape.

25. A method of growing a graded core/shell semiconductor nanorod, comprising:

providing a semiconductor nanorod core,

combining the core with at least one surfactant,

heating the surfactant/core mixture,

combining the mixture with a solution,

wherein said solution comprises semiconductor precursors in molar ratio sufficient to cause the growth of a graded semiconductor shell on the core.

26. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

the semiconductor nanorod core comprises a semiconductor material selected from the group consisting of Group II-VI, Group III-V and Group IV semiconductors.

27. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

the core is rod shaped.

28. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

the core comprises CdSe.

29. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

the mixture is heated to a temperature between 100-360 °C.

30. The method of growing a graded core/shell semiconductor nanorod of claim 29, wherein:

the mixture is heated to a temperature of 160°C.

31. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

only one surfactant is combined with the core.

32. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

the surfactant is chosen from the group consisting of TOPO, TBP, HDA, HPA and TDPA.

33. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

the mixture is kept at a temperature of approximately 160° for between 5 minutes and 24 hours after combining the solution.

34. The method of growing a graded core/shell semiconductor nanorod of claim 33, wherein:

the mixture is kept at a temperature of 160°C for 10 minutes after combining the solution.

35. The method of growing a graded core/shell semiconductor nanorod 25, wherein:

the core is a shaped nanorod.

36. The method of growing a graded core/shell semiconductor nanorod of claim 35, wherein:

the core has a tetrapod shape.

37. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

the graded core/shell nanorod is photochemically annealed.

38. The method of growing a graded core/shell semiconductor nanorod of claim 37, wherein:

the annealing is done using an Ar+ laser.

39. The method of growing a graded core/shell semiconductor nanorod of claim 25, wherein:

the core comprises CdSe and the graded shell comprises CdS/ZnS.

40. A graded core/shell semiconductor nanorod comprising:

at least a first segment comprising:

a core comprising a Group II-VI, Group III-V or a Group IV semiconductor,

a graded shell overlying the core,

wherein the graded shell comprises at least two monolayers,

wherein the at least two monolayers each independently comprise a Group II-VI, Group III-V or a Group IV semiconductor.

41. The graded core/shell semiconductor nanorod of claim 40, wherein:

the graded shell has at least three monolayers, and

the monolayer closest to the core comprises a first semiconductor material, and

the outermost monolayer comprises a second semiconductor material, wherein

between the monolayer closest to the core and the outermost monolayer there exists a concentration gradient of the first and second semiconductor material.

42. The graded core/shell semiconductor nanorod of claim 40, wherein:

the number of monolayers is between two and eight.

43. The graded core/shell semiconductor nanorod of claim 42, wherein:

the number of monolayer is between 2 and 6.

44. The graded core/shell semiconductor nanorod of claim 40, wherein:

there is a tail extending longitudinally from the core.

45. The graded core/shell semiconductor nanorod of claim 40, wherein:

the core comprises CdSe and the graded core/shell comprises CdS/ZnS.

46. The graded core/shell semiconductor nanorod of claim 40, wherein:

there is joined to the first segment a second segment comprising:

a core comprising a Group II-VI, Group III-V or a Group IV semiconductor,

a graded shell overlying the core,

wherein the graded shell comprises at least two monolayers,

wherein the at least two monolayers each independently comprise a Group II-VI, Group III-V or a Group IV semiconductor.

47. The graded core/shell semiconductor nanorod of claim 46, wherein:

the second segment core comprises CdSe and the second segment graded shell monolayers comprise, in order, CdS/ZnS.

48. The graded core/shell semiconductor nanorod of claim 47, wherein:

the first and the second segments have different cross sectional areas.

49. The graded core/shell semiconductor nanorod of claim 47, wherein:

there is a third segment joined to the second segment.

50. The graded core/shell semiconductor nanorod of claim 49, wherein:

the first, second and third segments have different cross sectional areas.

51. A nanorod barcode, comprising:

a first segment of a first material; and

a second segment of a second material joined longitudinally to said first segment;

wherein at least one of the first and second segments is capable of generating emission in response to excitation energy.

52. The nanorod barcode of claim 51, wherein:

said first and second segments comprise a nanorod core, and

said first and second segment cores independently comprise either a semiconductor material selected from the group consisting of Group II-VI, Group III-V and Group IV semiconductors or a metal selected from the group consisting of transition metals, oxides and nitrides thereof.

53. The nanorod barcode of claim 52, wherein:

said first and second segment cores independently comprise a semiconductor material selected from the group consisting of Group II-VI, Group III-V and Group IV semiconductors.

54. The nanorod barcode of claim 52, wherein:

said first segment core comprises a metal selected from the group consisting of transition metals, oxides and nitrides thereof, and

said second segment comprises a semiconductor material selected from the group consisting of Group II-VI, Group III-V and Group IV semiconductors.

55. The nanorod barcode of claim 52, further comprising:

a third segment connected longitudinally to said first segment core, and

said third segment core comprising a semiconductor material selected from the group consisting of Group II-VI, Group III-V and Group IV semiconductors.

56. The nanorod barcode of claim 55, wherein:

said second and third segments have different cross sectional areas.

57. The nanorod barcode of claim 55, wherein:

said first segment core comprises Co, and said second and third segment cores comprise CdSe.

58. The nanorod barcode of claim 53, wherein:

said first and second segments have different cross sectional areas.

59. The nanorod barcode of claim 58, wherein:

at least one of said first and second segment cores have a graded shell overlying the core.

60. The nanorod barcode of claim 58, wherein:

both segment cores have a graded shell overlying said cores.

61. The nanorod barcode of claim 53, wherein:

there is a third segment joined longitudinally to said second segment, and

said third segment comprises a semiconductor material selected from the group consisting of Group II-VI, Group III-V and Group IV semiconductors.

62. The nanorod barcode of claim 61, wherein:

at least one of said first and second and third segment cores have a graded shell overlying the core.

63. The nanorod barcode of claim 62, wherein:

all segment cores have a graded shell overlying the cores.

64. The nanorod barcode of claim 55, wherein:

said first, second and third segments have different cross sectional areas.

65. A method of using a nanorod barcode to identify an element, comprising:

labeling at least one identifiable element with at least one nanorod barcode as claimed in claim 51.